SHARP ENGLISH

SCIENTIFIC CALCULATOR

WriteView

MODEL **EL-W506X** **EL-W516X**

OPERATION MANUAL

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INTRODUCTION

Thank you for purchasing the SHARP Scientific Calculator Model EL-W506X/W516X.

About the **calculation examples (including some formulas and tables)**, refer to the **calculation example** sheet. **Refer to the number on the right of each title in the manual for use.**

After reading this manual, store it in a convenient location for future reference.

Notes:

- Some of the models described in this manual may not be available in some countries.
- This product uses a period as a decimal point.

Operational Notes

- Do not carry the calculator around in your back pocket, as it may break when you sit down. The display is made of glass and is particularly fragile.
- Keep the calculator away from extreme heat such as on a car dashboard or near a heater, and avoid exposing it to excessively humid or dusty environments.
- Since this product is not waterproof, do not use it or store it where fluids, for example water, can splash onto it. Raindrops, water spray, juice, coffee, steam, perspiration, etc. will also cause malfunction.
- Clean with a soft, dry cloth. Do not use solvents or a wet cloth. Avoid using a rough cloth or anything else that may cause scratches.
- Do not drop it or apply excessive force.
- Never dispose of batteries in a fire.
- Keep batteries out of the reach of children.
- For the sake of your health, try not to use this product for long periods of time. If you need to use the product for an extended period, be sure to allow your eyes, hands, arms, and body adequate rest periods (about 10~15 minutes every hour).
  If you experience any pain or fatigue while using this product, discontinue use immediately. If the discomfort continues, please consult a doctor.
- This product, including accessories, may change due to upgrading without prior notice.

NOTICE

- SHARP strongly recommends that separate permanent written records be kept of all important data. Data may be lost or altered in virtually any electronic memory product under certain circumstances. Therefore, SHARP assumes no responsibility for data lost or otherwise rendered unusable whether as a result of improper use, repairs, defects, battery replacement, use after the specified battery life has expired, or any other cause.
- SHARP will not be liable nor responsible for any incidental or consequential economic or property damage caused by misuse and/or malfunctions of this product and its peripherals, unless such liability is acknowledged by law.

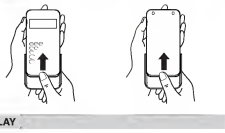
♦ Press the RESET switch (on the back), with the tip of a ball-point pen or similar object, only in the following cases:

- When using for the first time
- After replacing the battery
- To clear all memory contents
- When an abnormal condition occurs and all keys are inoperative

Do not use an object with a breakable or sharp tip. Note that pressing the RESET switch erases all data stored in memory.

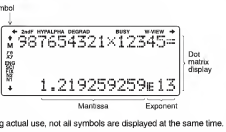
If service should be required on this calculator, use only a SHARP servicing dealer, SHARP approved service facility, or SHARP repair service where available.

Hard Case



DISPLAY

Symbol



- During actual use, not all symbols are displayed at the same time.
- Only the symbols required for the usage currently being explained are shown in the display and calculation examples in this manual.

◆/◆: Indicates that some contents are hidden in the directions shown.

2ndF: Appears when [2ndF] is pressed, indicating that the functions shown in orange are enabled.

HYP: Indicates that [hyp] has been pressed and the hyperbolic functions are enabled. If [2ndF] [sin⁻¹] is pressed, the symbols **2ndF HYP** appear, indicating that inverse hyperbolic functions are enabled.

ALPHA: Indicates that [ALPHA], [STO] or [RCL] has been pressed, and entry (recall) of memory contents and recall of statistics can be performed.

DEG/RAD/GRAD: Indicates angular units.

BUSY: Appears during the execution of a calculation.

W-VIEW: Indicates that the WriteView editor is selected.

M: Indicates that a numerical value is stored in the independent memory (M).

↑6/↓7: Indicates the mode of expression for results in CPLX mode.

ENG/SCI/FIX/N2/N1: Indicates the notation used to display a value and changes by SET UP menu. **N1** is displayed on-screen as "NORM1", and **N2** as "NORM2".

BEFORE USING THE CALCULATOR

When using for the first time, press the RESET switch (on the back), with the tip of a ball-point pen or similar object.

Adjusting the Display Contrast

Press [2ndF] [SET UP] [3], then [+] or [−] to adjust the contrast. Press [ON/C] to exit.

Power On and Off

Press [ON/C] to turn the calculator on. The data that was on-screen when the power was turned off will appear on the display.

Press [2ndF] [OFF] to turn the calculator off.

Key Notations Used in this Manual

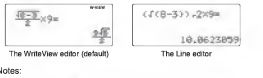
In this manual, key operations are described as follows:

e^x_ln ln — To specify e^x: [2ndF] [e^x]; To specify ln: [ln]; To specify E: [ALPHA] [E]

- Functions that are printed in orange above the key require [2ndF] to be pressed first before the key. When you specify the memory, press [ALPHA] first. Numbers for input values are not shown as keys, but as ordinary numbers.
- Functions that are printed in gray adjacent to the keys are effective in specific modes.
- The multiplication operator "×" is differentiated from the letter "X" in this manual as follows:
  To specify the multiplication operator: [×]
  To specify the letter "X": [ALPHA] [X]

The WriteView and Line Editors

This calculator has the following two editors in NORMAL mode: WriteView and Line. You can select between them in the SET UP menu.



The WriteView editor (default) — The Line editor

Notes:

- The WriteView Editor is only available in NORMAL mode.
- In certain calculation examples, where you see the **LINE** symbol, the key operations and calculation results are shown as they would appear in the Line editor.

Clearing the Entry and Memories

Operation	Entry (Display)	A–F, M, X, Y	F1–F4, D1–D4*2	ANS	STAT*3	matA–D*4, L1–L4*5
[ON/C]	○	×	×	×	×	×
[2ndF] [CA]	○	×	×	○	○	○
Mode selection ([MODE])	○	×	×	×	×*6	○
[2ndF] [M-CLR] [0] *7	○	×	×	×	×	×
[2ndF] [M-CLR] [1] [0] *7	○	○	○	○	○	○
[2ndF] [M-CLR] [2] [0] *7,*8	○	○	○	○	○	○
RESET switch*8	○	○	○	○	○	○

○: Clear ×: Retain

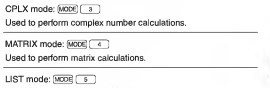
*1 Press [ON/C] [STO] and then choose a memory to clear one variable memory.
*2 Formula memories and definable memories. See "Memory Calculations".
*3 Statistical data (entered data)
*4 Matrix memories (matA, matB, matC, and matD)
*5 List memories (L1, L2, L3, and L4)
*6 Cleared when changing between sub-modes in STAT mode.
*7 See "Memory clear key".
*8 The username you stored using the name display function will be cleared as well.

Memory clear key

Press [2ndF] [M-CLR] to display the menu.

- To initialize the display settings, press [0]. The parameters are set as follows:
  - Angular unit: DEG
  - Display notation: NORM1
  - N-base: DEC
- To clear all variables and memories (A–F, M, X, Y, F1–F4, D1–D4, ANS, STAT, matA–D, and L1–L4) at once, press [1] [0].
- To RESET the calculator, press [2] [0]. The RESET operation will erase all data stored in memory and restore the calculator's default settings. You can do the same thing by pressing the RESET switch on the back of the calculator.

Mode Selection



NORMAL mode: [MODE] [0] (default)
Used to perform arithmetic operations and function calculations.

STAT mode: [MODE] [1]
Used to perform statistical operations.

DRILL mode: [MODE] [2]
Used to practice math and multiplication table drills.

CPLX mode: [MODE] [3]
Used to perform complex number calculations.

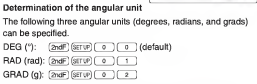
MATRIX mode: [MODE] [4]
Used to perform matrix calculations.

LIST mode: [MODE] [5]
Used to perform list calculations.

EQUATION mode: [MODE] [6]
Used to solve equations.

SET UP Menu

Press [2ndF] [SET UP] to display the SET UP menu.



Press [ON/C] to exit the SET UP menu.

Determination of the angular unit

The following three angular units (degrees, radians, and grads) can be specified.

DEG (°): [2ndF] [SET UP] [0] [0] (default)
RAD (rad): [2ndF] [SET UP] [0] [1]
GRAD (g): [2ndF] [SET UP] [0] [2]

Selecting the display notation and decimal places

Five display notation systems are used to display calculation results: Two settings of Floating point (NORM1 and NORM2), Fixed decimal point (FIX), Scientific notation (SCI), and Engineering notation (ENG).

- When [2ndF] [SET UP] [1] [0] (FIX) or [2ndF] [SET UP] [1] [2] (ENG) is pressed, "TAB(0–9)?" will be displayed and the number of decimal places (TAB) can be set to any value between 0 and 9.
- When [2ndF] [SET UP] [1] [1] (SCI) is pressed, "SIG(0–9)?" will be displayed and the number of significant digits can be set to any value between 0 and 9. Entering 0 will set a 10-digit display.

Setting the floating point number system in scientific notation

Two settings are used to display a floating-point number: NORM1 (the default) and NORM2. A number is automatically displayed in scientific notation outside a preset range:

- NORM1 ([2ndF] [SET UP] [1] [3]): $0.000000001 \le |x| \le 9{,}999{,}999{,}999$
- NORM2 ([2ndF] [SET UP] [1] [4]): $0.01 \le |x| \le 9{,}999{,}999{,}999$

Selecting the editor

Two editors are available in NORMAL mode:

- The WriteView editor (W-VIEW): [2ndF] [SET UP] [2] [0] (default)
- The Line editor (LINE): [2ndF] [SET UP] [2] [1]

Note: Any entries will be cleared when you change the editor.

Adjusting the display contrast

Press [2ndF] [SET UP] [3], then [+] or [−] to adjust the contrast. Press [ON/C] to exit.

Insert and overwrite entry methods

When using the Line editor, you can change the entry method from "INSERT" (the default) to "OVERWRITE".

After you switch to the overwrite method (by pressing [2ndF] [SET UP] [4] [1]), the triangular cursor will change to a rectangular one, and the number or function underneath it will be overwritten as you make entries.

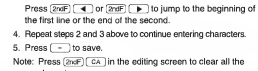
Name display function

You can save a username in this calculator. When you turn the power off, the saved username is displayed momentarily.

Up to 32 characters may be saved, split over two lines.

Entering and editing the username:

1. Press [2ndF] [SET UP] [5]. The editing screen appears with a flashing cursor.



2. Use [▲] and [▼] to scroll through the available characters. The following characters can be entered (listed in the order that they appear):
   Letters (A to Z, uppercase only), numbers (0 to 9), slash (/), hyphen (-), colon (:), apostrophe (′), comma (,), period (.), and space ( ).
   Press [2ndF] [▲] to jump to "A", and press [2ndF] [▼] or [ON/C] to jump to the space.
3. Pressing [◀] or [▶] moves the cursor to the left or right.
   To modify a character, use [◀] or [▶] to move the cursor to the character, then select another character using [▲] or [▼].
   Press [2ndF] [◀] or [2ndF] [▶] to jump to the beginning of the first line or the end of the second.
4. Repeat steps 2 and 3 above to continue entering characters.
5. Press [=] to save.

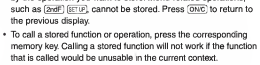
Note: Press [2ndF] [CA] in the editing screen to clear all the characters.

ENTERING, DISPLAYING, AND EDITING THE EQUATION

The WriteView Editor

Entry and display

In the WriteView editor, you can enter and display fractions or certain functions as you would write them.



Notes:

- The WriteView editor can only be used in NORMAL mode.
- If the equation grows too large, it may extend off the edge of the display after you obtain the result. If you want to see the entire equation, press [◀] or [▶] to return to the editing screen.

Displaying calculation results

When possible, calculation results will be displayed using fractions, √, and π. When you press [MATH], the display will cycle through the following display styles:

- Mixed fractions (with or without π) → improper fractions (with or without π) → decimal numbers
- Proper fractions (with or without π) → decimal numbers
- Irrational numbers (square roots, fractions made using square roots) → decimal numbers

Notes:

- In the following cases, calculation results may be displayed using √:
  - Arithmetic operations and memory calculations
  - Trigonometric calculations
- In trigonometric calculations, when entering values such as those in the table to the right, results may be shown using √.

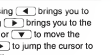
	Entry value
DEG	multiples of 15
RAD	multiples of $\frac{1}{12}\pi$
GRAD	multiples of $\frac{50}{9}$

- Calculation results may extend off the edges of the screen. You can see those parts by pressing [◀] or [▶] (depending on whether the left or right portion is hidden).
- Improper/proper fractions will be converted to and displayed as decimal numbers if the number of digits used in their expression is greater than nine. In the case of mixed fractions, the maximum number of displayable digits (including integers) is eight.
- If the number of digits in the denominator of a fractional result that uses π is greater than three, the result is converted to and displayed as a decimal number.

The Line Editor

Entry and display

In the Line editor, you can enter and display equations line by line.



Notes:

- Up to three lines of text may be viewed on the screen at one time.
- If the length of the equation exceeds three lines, parts of it may be hidden from view after calculation. If you want to see the rest of the equation, press [◀] or [▶] to return to the editing screen.
- In the Line editor, calculation results are displayed in decimal form or line fraction notation if possible.

Editing the Equation

Just after obtaining an answer, pressing [◀] brings you to the end of the equation and pressing [▶] brings you to the beginning. Press [◀], [▶], [▲], or [▼] to move the cursor. Press [2ndF] [◀] or [2ndF] [▶] to jump the cursor to the beginning or the end of the equation.

In the WriteView editor, you can use [▲] and [▼] to move the cursor up and down—between the numerator and denominator, for example.

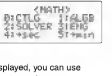
Back space and delete key

To delete a number or function, move the cursor to the right of it, then press [BS]. You can also delete a number or function that the cursor is directly over by pressing [2ndF] [DEL].

The MATH Menu

Other functions may be available on this calculator besides those printed on the key pad. These functions are accessed using the MATH menu. The MATH menu has different contents for each mode.

Press [MATH] to display the MATH menu. For example, in NORMAL mode, you can call the functions shown on the right.



Notes:

- When the ↑ or ↓ symbols are displayed, you can use [▲] or [▼] to display any hidden menu items.
- [MATH] does not function when entering values or items in STAT, MATRIX, LIST, or EQUATION modes, or into solver functions or simulation calculations.

The CATALOG Menu

Using the CATALOG menu, you can select functions and variables that are available for what you are doing in the currently selected mode. To display the CATALOG menu, press [MATH] [0].

- Press [▲] or [▼] to move the cursor (▷) and press [ENTER] to select.
- Press [◀] or [▶] to scroll up or down.
- Press [2ndF] [▲] or [2ndF] [▼] to jump to the first or last item.

Note: You cannot bring up the CATALOG menu when entering values or items in STAT, MATRIX, LIST, or EQUATION modes, or into solver functions or simulation calculations.

Multi-line Playback Function

This calculator is equipped with a function to recall previous equations and answers in NORMAL or CPLX modes. A maximum of 340 characters can be stored in memory. When the memory is full, stored equations will be deleted to make room, starting with the oldest.

Pressing [▲] will display the previous equation. Further pressing [▲] will display preceding equations (after returning to the previous equation, press [▼] to view equations in order). In addition, [2ndF] [▲] can be used to jump to the oldest equation, and [2ndF] [▼] to jump to the newest one.

- To edit an equation after recalling it, press [◀] or [▶].
- The multi-line memory will be cleared by the following operations:
  [2ndF] [CA], mode change, RESET, N-base conversion, angular unit conversion, editor change ([2ndF] [SET UP] [3] [0] or [2ndF] [SET UP] [2] [1]), and memory clear ([2ndF] [M-CLR] [1] [0]).
- Equations that have one result require an additional eleven characters' worth of memory to store in order to hold the result.
- In addition to the amount of memory needed to store an equation, the WriteView editor will require a certain amount for the sake of display.
- Equations also include calculation ending instructions, such as "=".

Priority Levels in Calculation

This calculator performs operations according to the following priority:

① Fractions (1r 4, etc.) ② ∠, Engineering prefixes
③ Functions preceded by their argument (x^{-1}, x^3, n!, etc.)
④ y^x, $\sqrt[x]{}$ ⑤ Implied multiplication of a memory value (2Y, etc.)
⑥ Functions followed by their argument (sin, cos, (−), etc.)
⑦ Implied multiplication of a function (2sin30, A $\frac{1}{x}$, etc.) ⑧ nCr, nPr, ×÷√ ⑨ ×, ÷ ⑩ +, − ⑪ AND ⑫ OR, XOR, XNOR ⑬ =, M+, M−, ⇒M, ▶DEG, ▶RAD, ▶GRAD, DATA, →rθ, →xy, and other calculation ending instructions

♦ If parentheses are used, parenthesized calculations have precedence over any other calculations.

SCIENTIFIC CALCULATIONS

- Press [MODE] [0] to select NORMAL mode.
- In each example, press [ON/C] to clear the display first. Unless otherwise specified, calculation examples are performed in the WriteView editor ([2ndF] [SET UP] [2] [0]) with the default display settings ([2ndF] [M-CLR] [0]).

Arithmetic Operations

- The closing parenthesis [)] just before [=] or [M+] may be omitted.

Constant Calculations

- In constant calculations, the addend becomes a constant. Subtraction and division are performed in the same manner. For multiplication, the multiplicand becomes a constant.
- In constant calculations, constants will be displayed as K.
- Constant calculations can be performed in NORMAL or STAT modes.

Functions

- Refer to the calculation examples for each function.
- In the Line editor, the following symbols are used:
  - ▲: to indicate an expression's power. ([y^x], [2ndF] [e^x], [2ndF] [10^x])
  - ■: to separate integers, numerators, and denominators. ([a/b], [2ndF] [a/b$_c$])
- When using [2ndF] [log$_a$x] or [2ndF] [abs] in the Line editor, values are entered in the following way:
  - logn (base, value)
  - abs value

Integral/Differential Functions

Integral and differential calculations can be performed in NORMAL mode.

Note: Since integral and differential calculations are performed based on the following equations, correct results may not be obtained, in certain rare cases, when performing special calculations that contain discontinuous points.

Integral calculation (Simpson's rule):

$$S=\frac{1}{3}\left[h\{f(a)+4\{f(a+h)+f(a+3h)+\cdots+f(a+(N-1)h)\}+2\{f(a+2h)+f(a+4h)+\cdots+f(a+(N-2)h)\}+f(b)\}\right] \quad h=\frac{b-a}{N},\ N=2n,\ 0\le s\le b$$

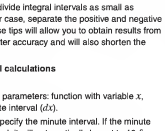
Differential calculation: $f'(x)=\dfrac{f(x+\frac{dx}{2})-f(x-\frac{dx}{2})}{dx}$.

Performing integral calculations

1. Press [∫dx].
2. Specify the following parameters: range of integral (initial value (a), end value (b)), function with variable x, and number of subintervals (n).
   You do not need to specify the number of subintervals. If the number of subintervals is not specified, the default value of n = 100 will be used.
3. Press [=].

Notes:

- Parameters are entered in the following way:
  WriteView editor:
  $\int_a^b$function[, subintervals]dx
  Line editor:
  ∫(function, a, b[, subintervals])
- Integral calculations, depending on the integrands and subintervals included, require longer calculation time. During calculation, the **BUSY** symbol will be displayed. To cancel calculation, press [ON/C].
  Note that there will be greater integral errors when there are large fluctuations in the integral values during minute shifting of the integral range and for periodic functions, etc., where positive and negative integral values exist depending on the interval.



  For the former case, divide integral intervals as small as possible. For the latter case, separate the positive and negative values. Following these tips will allow you to obtain results from calculations with greater accuracy and will also shorten the calculation time.

Performing differential calculations

1. Press [2ndF] [dd/dx].
2. Specify the following parameters: function with variable x, value of x, and minute interval (dx).
   You do not need to specify the minute interval. If the minute interval is not specified, it will automatically be set to 10^{-5} (while $x = 0$), or $|x| \times 10^{-5}$ (while $x \neq 0$).
3. Press [=].

Note: Parameters are entered in the following way:
WriteView editor:
$\frac{d(\text{function})}{dx}\Big|_{x=\text{value of } x[,\text{ minute interval}]}$
Line editor:
d/dx (function, value of x[, minute interval])

∑ Function

The ∑ function returns the cumulative sum of a given expression from an initial value to an end value in NORMAL mode.

Performing ∑ calculations

1. Press [2ndF] [∑].
2. Specify the following parameters: initial value, end value, function with variable x, and increment (n).
   You do not need to specify the increment. If the increment is not specified, the default value of n = 1 will be used.
3. Press [=].

Note: Parameters are entered in the following way:
WriteView editor:
$\sum_{x=\text{initial value}}^{\text{end value}}(\text{function[, increment]})$
Line editor:
∑(function, initial value, end value[, increment])

Random Function

The random function has four settings. (This function cannot be selected while using the N-base function.) To generate further random numbers in succession, press [ENTER]. Press [ON/C] to exit.

Random numbers

A pseudo-random number, with three significant digits from 0 up to 0.999, can be generated by pressing [2ndF] [RANDOM] [0] [ENTER].

Note: In the WriteView editor, if the result is not 0 it can be shown as a fraction or decimal using [a/b/c].

Random dice

To simulate a die-rolling, a random integer between 1 and 6 can be generated by pressing [2ndF] [RANDOM] [1] [ENTER].

Random coin

To simulate a coin flip, 0 (heads) or 1 (tails) can be randomly generated by pressing [2ndF] [RANDOM] [2] [ENTER].

Random integer

An integer between 0 and 99 can be generated randomly by pressing [2ndF] [RANDOM] [3] [ENTER].

Angular Unit Conversions

Each time [2ndF] [DRG▶] is pressed, the angular unit changes in sequence.

Memory Calculations

Mode	ANS	M, F1–F4	A–F, X, Y	D1–D4
NORMAL	○	○	○	○
STAT	○	○	○	○
CPLX	○	○	×	○
MATRIX	○	○	○	○
LIST	○	○	○	○

○: Available ×: Unavailable

Temporary memories (A–F, X and Y)

Press [STO] and a variable key to store a value in memory.

Press [RCL] and a variable key to recall the value from that memory. To place a variable in an equation, press [ALPHA] and a variable key.

Independent memory (M)

In addition to all the features of temporary memories, a value can be added to or subtracted from an existing memory value.

Press [ON/C] [STO] [M] to clear the independent memory (M).

Last answer memory (ANS)

The calculation result obtained by pressing [=] or any other calculation ending instruction is automatically stored in the last answer memory.

When the calculation result is in matrix or list form, the full matrix or list is not stored into ANS memory. Only the value of the element covered by the cursor is stored.

Notes:

- Calculation results from the functions indicated below are automatically stored in the X or Y memories replacing any existing values.
  - →rθ, →xy: X memory (r or x), Y memory (θ or y)
  - Two x^- values from a quadratic regression calculation in STAT mode: X memory (1:), Y memory (2:)
- Use of [RCL] or [ALPHA] will recall the value stored in memory using up to 14 digits.

Formula memories (F1–F4)

You can store expressions in formula memories (F1–F4). Storing a new expression in a memory space will automatically replace any content that may already exist there.

Notes:

- Expressions that are stored from the WriteView editor cannot be recalled from within the Line editor, and vice versa.
- You can only recall expressions stored from the Line editor when entering values or items in STAT, MATRIX, LIST, or EQUATION modes, or into solver functions or simulation calculations.
- Any recalled expressions will overwrite any expressions that are currently being entered.
- You cannot store formulas in formula memories when entering values or items in STAT, MATRIX, LIST, or EQUATION modes, or into solver functions or simulation calculations.

Definable memories (D1–D4)

You can store functions or operations in definable memories (D1–D4).

- To store a function or operation, press [STO], followed by a definable memory key ([D1], [D2], [D3], or [D4]), followed by the operation you want to store. Menu-related operations, such as [2ndF] [SET UP], cannot be stored. Press [ON/C] to return to the previous display.
- To call a stored function or operation, press the corresponding memory key. Calling a stored function will not work if the function that is called would be unusable in the current context.
- Any functions or operations that are stored in a definable memory will be replaced when you save a new one into that memory.
- You cannot store functions or operations in definable memories when entering values or items in STAT, MATRIX, LIST, or EQUATION modes, or into solver functions or simulation calculations.

Chain Calculations

The previous calculation result can be used in the subsequent calculation. However, it cannot be recalled after entering multiple instructions or when the calculation result is in matrix/list format.

Fraction Calculations

Arithmetic operations and memory calculations can be performed using fractions. In NORMAL mode, conversion between a decimal number and a fraction can be performed by pressing [a/b/c].

Notes:

- Improper/proper fractions will be converted to and displayed as decimal numbers if the number of digits used in their expression is greater than nine. In the case of mixed fractions, the maximum number of displayable digits (including integers) is eight.
- To convert a sexagesimal value to a fraction, first convert it by pressing [2ndF] [°'"▶S].

Binary, Pental, Octal, Decimal, and Hexadecimal Operations (N-base)

Conversions can be performed between N-base numbers in NORMAL mode. The four basic arithmetic operations, calculations with parentheses, and memory calculations can also be performed, along with the logical operations AND, OR, NOT, NEG, XOR, and XNOR on binary, pental, octal, and hexadecimal numbers.

Conversion to each system is performed with the following keys:

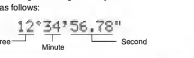
[2ndF] [▶BIN] ("BIN" appears), [2ndF] [▶PEN] ("PEN" appears), [2ndF] [▶OCT] ("OCT" appears), [2ndF] [▶HEX] ("HEX" appears), [2ndF] [▶DEC] ("BIN", "PEN", "OCT", and "HEX" disappear)

Note: The hexadecimal numbers A–F are entered by pressing [DEG], [x^2], [x^3], [log], [ln], and [$\sqrt{x}$].

In the binary, pental, octal, and hexadecimal systems, fractional parts cannot be entered. When a decimal number having a fractional part is converted into a binary, pental, octal, or hexadecimal number, the fractional part will be truncated. Likewise, when the result of a binary, pental, octal, or hexadecimal calculation includes a fractional part, the fractional part will be truncated. In the binary, pental, octal, and hexadecimal systems, negative numbers are displayed as a complement.

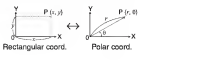
Time, Decimal, and Sexagesimal Calculations

You can convert between decimal and sexagesimal numbers, and from sexagesimal numbers to seconds or minutes. In addition, the four basic arithmetic operations and memory calculations can be performed using the sexagesimal system. Notation for sexagesimal is as follows:



Coordinate Conversions

- Before performing a calculation, select the angular unit.
- The calculation result is automatically stored in the X and Y memories (r or x in X memory, and θ or y in Y memory).
- The results of coordinate conversions will be displayed as decimal numbers even in the WriteView editor.



Notes:

- The WriteView editor can only be used in NORMAL mode.
- If the equation grows too large, it may extend off the edge of the display after you obtain the result. If you want to see the entire equation, press [◀] or [▶] to return to the editing screen.

Displaying calculation results

When possible, calculation results will be displayed using fractions, √, and π. When you press [MATH], the display will cycle through the following display styles:

- Mixed fractions (with or without π) → improper fractions (with or without π) → decimal numbers
- Proper fractions (with or without π) → decimal numbers
- Irrational numbers (square roots, fractions made using square roots) → decimal numbers

Notes:

- In the following cases, calculation results may be displayed using √:
  - Arithmetic operations and memory calculations
  - Trigonometric calculations
- In trigonometric calculations, when entering values such as those in the table to the right, results may be shown using √.

	Entry value
DEG	multiples of 15
RAD	multiples of $\frac{1}{12}\pi$
GRAD	multiples of $\frac{50}{9}$

- Calculation results may extend off the edges of the screen. You can see those parts by pressing [◀] or [▶] (depending on whether the left or right portion is hidden).
- Improper/proper fractions will be converted to and displayed as decimal numbers if the number of digits used in their expression is greater than nine. In the case of mixed fractions, the maximum number of displayable digits (including integers) is eight.
- If the number of digits in the denominator of a fractional result that uses π is greater than three, the result is converted to and displayed as a decimal number.

The Line Editor

Entry and display

In the Line editor, you can enter and display equations line by line.

Notes:

- Up to three lines of text may be viewed on the screen at one time.
- If the length of the equation exceeds three lines, parts of it may be hidden from view after calculation. If you want to see the rest of the equation, press [◀] or [▶] to return to the editing screen.
- In the Line editor, calculation results are displayed in decimal form or line fraction notation if possible.

Editing the Equation

Just after obtaining an answer, pressing [◀] brings you to the end of the equation and pressing [▶] brings you to the beginning. Press [◀], [▶], [▲], or [▼] to move the cursor. Press [2ndF] [◀] or [2ndF] [▶] to jump the cursor to the beginning or the end of the equation.

In the WriteView editor, you can use [▲] and [▼] to move the cursor up and down—between the numerator and denominator, for example.

Back space and delete key

To delete a number or function, move the cursor to the right of it, then press [BS]. You can also delete a number or function that the cursor is directly over by pressing [2ndF] [DEL].

The MATH Menu

Other functions may be available on this calculator besides those printed on the key pad. These functions are accessed using the MATH menu. The MATH menu has different contents for each mode.

Press [MATH] to display the MATH menu. For example, in NORMAL mode, you can call the functions shown on the right.

Notes:

- When the ↑ or ↓ symbols are displayed, you can use [▲] or [▼] to display any hidden menu items.
- [MATH] does not function when entering values or items in STAT, MATRIX, LIST, or EQUATION modes, or into solver functions or simulation calculations.

Physical Constants and Metric Conversions

Calculations using physical constants

To recall a constant, press [CNST], then select a physical constant from the list. (Each item is labeled with a 2-digit number.)

- To scroll up or down the list of constants, press [▲] ([◀] or [▼] ([▶]).
  Use [2ndF] [▲] ([◀]) or [2ndF] [▼] ([▶]) to jump to the first or last page.
- Enter the first digit of the 2-digit item number to jump to the page containing the number that begins with that digit.
- When you enter the second digit, the constant is displayed automatically according to the display and decimal placement settings.
- Physical constants can be recalled in NORMAL (excluding N-base), STAT, CPLX, MATRIX, LIST, and EQUATION modes.
- The following table lists the physical constants. See the calculation example sheet for physical constant symbols and units.

Note: Physical constants and metric conversions are based on the 2006 CODATA recommended values, or on the 1995 Edition of the "Guide for the Use of the International System of Units (SI)" released by NIST (National Institute of Standards and Technology).

No.	Constant	No.	Constant
01	Speed of light in vacuum	27	Stefan-Boltzmann constant
02	Newtonian constant of gravitation	28	Avogadro constant
03	Standard acceleration of gravity	29	Molar volume of ideal gas (273.15 K, 101.325 kPa)
04	Electron mass	30	Molar gas constant
05	Proton mass	31	Faraday constant
06	Neutron mass	32	Von Klitzing constant
07	Muon mass	33	Electron charge to mass quotient
08	Atomic mass unit-kilogram relationship	34	Quantum of circulation
09	Elementary charge	35	Proton gyromagnetic ratio
10	Planck constant	36	Josephson constant
11	Boltzmann constant	37	Electron volt
12	Magnetic constant	38	Celsius Temperature
13	Electric constant	39	Astronomical unit
14	Classical electron radius	40	Parsec
15	Fine-structure constant	41	Molar mass of carbon-12
16	Bohr radius	42	Planck constant over 2 pi
17	Rydberg constant	43	Hartree energy
18	Magnetic flux quantum	44	Conductance quantum
19	Bohr magneton	45	Inverse fine-structure constant
20	Electron magnetic moment	46	Proton-electron mass ratio
21	Nuclear magneton	47	Molar mass constant
22	Proton magnetic moment	48	Neutron Compton wavelength
23	Neutron magnetic moment	49	First radiation constant
24	Muon magnetic moment	50	Second radiation constant
25	Compton wavelength	51	Characteristic impedance of vacuum
26	Proton Compton wavelength	52	Standard atmosphere

Metric conversions

Enter a value to be converted, then press [2ndF] [CONV], and select a metric conversion by entering its 2-digit number.

- The metric conversion list is used in the same manner as the list of physical constants.
- Unit conversions can be performed in NORMAL (excluding N-base), STAT, MATRIX, LIST, and EQUATION modes.
- The following table lists units used in metric conversion. See the calculation example sheet for the metric conversion reference table.

No.	Remarks	No.	Remarks
01	in : inch	23	fl oz(US): fluid ounce (US)
02	cm : centimeter	24	mL : milliliter
03	ft : foot	25	fl oz(UK): fluid ounce (UK)
04	m : meter	26	mL : milliliter
05	yd : yard	27	cal$_{th}$: calorie$_{th}$
06	m : meter	28	J : joule
07	mi : mile	29	cal$_{15}$: calorie (15°C)
08	km : kilometer	30	J : joule
09	n mi : nautical mile	31	cal$_{IT}$: calorie$_{IT}$
10	m : meter	32	J : joule
11	acre : acre*1	33	hp : horsepower (UK)
12	m^2 : square meter	34	W : watt
13	oz : ounce (avoirdupois)	35	ps : horsepower (metric)
14	g : gram	36	W : watt
15	lb : pound (avoirdupois)	37	(kgf/cm^2)
16	kg : kilogram	38	Pa : pascal
17	°F : degree Fahrenheit	39	atm : atmosphere
18	°C : degree Celsius	40	Pa : pascal
19	gal (US): gallon (US)	41	(1 mmHg = 1 Torr)
20	L : liter	42	Pa : pascal
21	gal (UK): gallon (UK)	43	(kgf·m)
22	L : liter	44	N·m : newton meter

*1 based on US survey foot

Calculations Using Engineering Prefixes

Calculation can be executed in NORMAL mode (excluding N-base) using the following 9 types of prefixes.

Prefix		Operation	Unit
k	(kilo)	[MATH] [3] [9]	10^3
M	(Mega)	[MATH] [3] [1]	10^6
G	(Giga)	[MATH] [3] [2]	10^9
T	(Tera)	[MATH] [3] [3]	10^{12}
m	(milli)	[MATH] [3] [4]	10^{-3}
μ	(micro)	[MATH] [3] [5]	10^{-6}
n	(nano)	[MATH] [3] [6]	10^{-9}
p	(pico)	[MATH] [3] [7]	10^{-12}
f	(femto)	[MATH] [3] [8]	10^{-15}

Modify Function

Decimal calculation results are internally obtained in scientific notation, with up to 14 digits in the mantissa. However, since calculation results are displayed in the form designated by the display notation and the number of decimal places indicated, the internal calculation result may differ from that shown in the display. By using the modify function ([2nd F] [MDF]), the internal value is converted to match that of the display, so that the displayed value can be used without change in subsequent operations.

- When using the WriteView editor, if the calculation result is displayed using fractions or irrational numbers, press [S⇔D] to convert it to decimal form first.
- The modify function can be used in NORMAL, STAT, MATRIX, or LIST modes.

Simulation Calculation (ALGB)

If you have to find values consecutively using the same expression, such as plotting a curve line for $2x^2 + 1$, or finding the variable values for $2x + 2y = 14$, once you enter the expression, all you have to do is to specify the value for the variable in the equation.

Usable variables: A–F, M, X and Y

- Simulation calculations can only be executed in NORMAL mode.
- Calculation ending instructions other than [=] cannot be used.

Performing calculations

1. Press [MODE] [0].
2. Input an expression with at least one variable.
3. Press [MATH] [1].
4. The variable entry screen will appear. Enter a value, then press [ENTER] to confirm. The calculation result will be displayed after you have entered a value for each variable used in the equation.
   - After completing the calculation, press [MATH] [1] to perform calculations using the same equation.
   - Variables and numerical values stored in the memories will be displayed in the variable entry screen. If you do not want to change any values, simply press [ENTER].
   - Performing simulation calculation will cause values in memory to be overwritten with new values.

Solver Function

The solver function finds the value for x that reduces the entered expression to zero.

- This function uses Newton's method to obtain an approximation. Depending on the function (e.g. periodic) or start value, an error may occur (ERROR 02) due to there being no convergence to the solution for the equation.
- The value obtained by this function may include a margin of error. If it is larger than acceptable, recalculate the solution after changing the "Start" and dx values.
- Change the "Start" value (e.g. to a negative value) or dx value (e.g. to a smaller value) if:
  - no solution can be found (ERROR 02).
  - more than two solutions appear to be possible (e.g. a cubic equation).
  - to improve arithmetic precision.
- The calculation result is automatically stored in the X memory.
- Press [ON/C] to exit the solver function.

Performing solver function

1. Press [MODE] [0].
2. Input an expression with an x variable.
3. Press [MATH] [2].
4. Enter a "Start" value and press [ENTER]. The default value is "0".
5. Press [ON/C] to exit the solver function.
6. Press [ENTER].

STATISTICAL CALCULATIONS

Statistical calculations can be performed in STAT mode.

There are eight sub-modes within STAT mode. Press [MODE] [1], then press the number key that corresponds to your choice:

[0] (Stat 0[SD]): Single-variable statistics
[1] (Stat 1[LINE]): Linear regression
[2] (Stat 2[QUAD]): Quadratic regression
[3] (Stat 3[E_EXP]): Euler exponential regression
[4] (Stat 4[LOG]): Logarithmic regression
[5] (Stat 5[POWER]): Power regression
[6] (Stat 6[INV]): Inverse regression
[7] (Stat 7[G_EXP]): General exponential regression

Statistical Calculations and Variables

The following statistics can be obtained for each statistical calculation (refer to the table below):

Single-variable statistical calculation

Statistics of ① and the value of the normal probability function.

Linear regression calculation

Statistics of ① and ②. In addition, the estimate of y for a given x (estimate y') and the estimate of x for a given y (estimate x').

Quadratic regression calculation

Statistics of ① and ②, and coefficients a, b, c in the quadratic regression formula ($y = a + bx + cx^2$). (For quadratic regression calculations, no correlation coefficient (r) can be obtained.) When there are two x' values, each value will be displayed with "1:" or "2:", and stored separately in the X and Y memories.

Euler exponential regression, logarithmic regression, power regression, inverse regression, and general exponential regression calculations

Statistics of ① and ②. In addition, the estimate of y for a given x and the estimate of x for a given y. (Since the calculator converts each formula into a linear regression formula before actual calculation takes place, it obtains all statistics, except coefficients a and b, from converted data rather than entered data.)

①	$\bar{x}$	Mean of samples (x data)
	sx	Sample standard deviation (x data)
	σx	Population standard deviation (x data)
	n	Number of samples
	Σx	Sum of samples (x data)
	Σx^2	Sum of squares of samples (x data)
②	$\bar{y}$	Mean of samples (y data)
	sy	Sample standard deviation (y data)
	σy	Population standard deviation (y data)
	Σy	Sum of samples (y data)
	Σy^2	Sum of squares of samples (y data)
	Σxy	Sum of products of samples (x, y)
	r	Correlation coefficient
	a	Coefficient of regression equation
	b	Coefficient of regression equation
	c	Coefficient of quadratic regression equation

- Use [ALPHA] and [RCL] to perform a variable calculation in STAT mode.
- [ENG] does not function in STAT mode.

Data Entry and Correction

Before entering new data, clear the memory contents ([2nd F] [CA]).

Data entry

Single-variable data

Data [DATA]

Data [x,y] *frequency* [DATA] (To enter multiples of the same data)

Two-variable data

Data x [x,y] *data y* [DATA]

Data x [x,y] *data y* [x,y] *frequency* [DATA] (To enter multiples of the same data x and y)

Note: Up to 100 data items can be entered. With the single-variable data, a data item without frequency assignment is counted as one data item, while an item assigned with frequency is stored as a set of two data items. With the two-variable data, a set of data items without frequency assignment is counted as two data items, while a set of items assigned with frequency is stored as a set of three data items.

Data correction

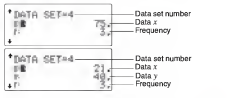
Correction before pressing [DATA] immediately after a data entry:

Delete incorrect data with [ON/C], then enter the correct data.

Correction after pressing [DATA]:

Use [▲] and [▼] to display the previously entered data set. Press [▼] to display the data set in ascending (oldest first) order. To reverse the display order to descending (latest first), press the [▲] key. Press [2nd F] [▲] or [2nd F] [▼] to jump the cursor to the beginning or end of the data set.

Each data set is displayed with "X:", "Y:", or "F:".



Display and move the cursor to the data item to be modified by using [▲] and [▼], enter the correct value, then press [DATA] or [ENTER].

- To delete a data set, display and move the cursor to an item of the data set to delete by using [▲] and [▼], then press [2nd F] [CO]. The data set will be deleted.
- To add a new data set, press [ON/C] to exit the display of previously entered data and input the values, then press [DATA].

Statistical Calculation Formulas

Type	Regression formula
Linear	$y = a + bx$
Quadratic	$y = a + bx + cx^2$
Euler exponential	$y = a \cdot e^{bx}$
Logarithmic	$y = a + b \cdot \ln x$
Power	$y = a \cdot x^b$
Inverse	$y = a + b \cdot \frac{1}{x}$
General exponential	$y = a \cdot b^x$

An error will occur when:

- The absolute value of the intermediate result or calculation result is equal to or greater than 1×10^{100}.
- The denominator is zero.
- An attempt is made to take the square root of a negative number.
- No solution exists in the quadratic regression calculation.

Normal Probability Calculations

In STAT mode, the three probability density functions can be accessed under the MATH menu, with a random number used as a normal distribution variable.

Notes:

- P(t), Q(t), and R(t) will always take positive values, even when t < 0, because these functions follow the same principle used when solving for an area.
- Values for P(t), Q(t), and R(t) are given to six decimal places.
- The standardization conversion formula is as follows:

$$t = \frac{x - \bar{x}}{\sigma x}$$

DRILL MODE

Math Drill: [MODE] [2] [0]

Math operation questions with positive integers and 0 are displayed randomly. It is possible to select the number of questions and operator type.

Multiplication Table (× Table): [MODE] [2] [1]

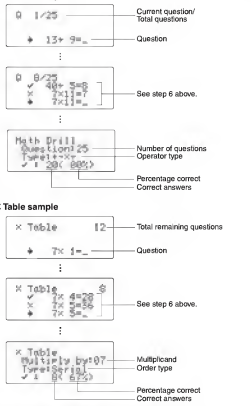
Questions from each row of the multiplication table (1 to 12) are displayed serially or randomly.

To exit DRILL mode, press [MODE] and select another mode.

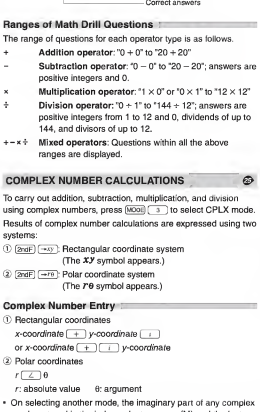
Using Math Drill and × Table

1. Press [MODE] [2] [0] for Math Drill or [MODE] [2] [1] for × Table.
2. **Math Drill**: Use [▲] and [▼] to select the number of questions (25, 50, or 100).
   × Table: Use [▲] and [▼] to select a row in the multiplication table (1 to 12).
3. **Math Drill:** Use [◀] and [▶] to select the operator type for questions (+, −, ×, ÷, or +−×÷).
   × Table: Use [◀] and [▶] to select the order type ("Serial" or "Random").
4. Press [ENTER] to start.
   When using Math Drill or × Table (random order only), questions are randomly selected and will not repeat except by chance.
5. Enter your answer. If you make a mistake, press [ON/C] or [BS] to clear any entered numbers, and enter your answer again.
6. Press [ENTER].
   - If the answer is correct, "✓" appears and the next question is displayed.
   - If the answer is wrong, "✗" appears and the same question is displayed. This will be counted as an incorrect answer.
   - If you press [ENTER] without entering an answer, the correct answer is displayed and then the next question is displayed. This will be counted as an incorrect answer.
7. Continue answering the series of questions by entering the answer and pressing [ENTER].
8. After you finish, press [ENTER] and the number and percentage of correct answers are displayed.
9. Press [SHIFT] to return to the initial screen for your current drill.

Math Drill sample



× Table sample



Ranges of Math Drill Questions

The range of questions for each operator type is as follows.

+ **Addition operator**: "0 + 0" to "20 + 20"
− **Subtraction operator**: "0 − 0" to "20 − 20"; answers are positive integers and 0.
× **Multiplication operator**: "1 × 0" or "0 × 1" to "12 × 12"
÷ **Division operator:** "0 ÷ 1" to "144 ÷ 12"; answers are positive integers from 1 to 12 and 0, dividends of up to 144, and divisors of up to 12.
+−×÷ **Mixed operators**: Questions within all the above ranges are displayed.

COMPLEX NUMBER CALCULATIONS

To carry out addition, subtraction, multiplication, and division using complex numbers, press [MODE] [3] to select CPLX mode. Results of complex number calculations are expressed using two systems:

① [2nd F] [←Y] Rectangular coordinate system (The *X*,*Y* symbol appears.)
② [2nd F] [→r θ] Polar coordinate system (The *r*,*θ* symbol appears.)

Complex Number Entry

① Rectangular coordinates
x-coordinate [+] *y-coordinate* [i]
or *x-coordinate* [+] [i] *y-coordinate*
② Polar coordinates
r [∠] θ
r: absolute value θ: argument

- On selecting another mode, the imaginary part of any complex number stored in the independent memory (M) and the last answer memory (ANS) will be cleared.
- A complex number expressed in rectangular coordinates with the y-value equal to zero, or expressed in polar coordinates with the angle equal to zero, is treated as a real number.
- Press [MATH] [1] to return the complex conjugate of the specified complex number.

MATRIX CALCULATIONS

You can store and calculate up to four matrices containing up to four rows and four columns each in MATRIX mode.

```
MATRIX MODE
```

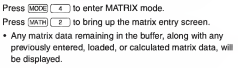
Press [MODE] [4] to enter MATRIX mode.

Note: You can use the MATH menu in MATRIX mode to edit, recall, and store matrices, as well as to call matrix-specific functions.

Entering and Storing Matrices

Before performing matrix calculations, a matrix must be created. Follow the steps below to enter and store matrices.

1. Press [MODE] [4] to enter MATRIX mode.
2. Press [MATH] [2] to bring up the matrix entry screen.
   - Any matrix data remaining in the buffer, along with any previously entered, loaded, or calculated matrix data, will be displayed.
3. Define the matrix dimensions (up to four rows by four columns) by entering the required dimensions using the number keys and pressing [ENTER].



Matrix entry screen (example)

4. Enter each element in the matrix by entering a value in the entry field and pressing [ENTER].
   - Each matrix element can display up to seven digits (the decimal point counts as one digit). If an element exceeds seven digits in length, it may be displayed in exponent notation within the matrix.
   - A maximum of three rows by three columns can be displayed at one time. Use [▲], [▼], [◀], and [▶] to move the cursor through the matrix.
5. When you have entered a value for each element, press [ON/C] to exit the matrix entry screen.
6. Press [MATH] [4] and select a memory (matA–matD) to store the newly-created matrix in.

Modifying a stored matrix

1. To load a stored matrix into the matrix entry screen, press [MATH] [3], then select the memory (matA–matD) that holds the matrix you wish to modify.
   - Loading new data into the screen will automatically replace any data that may already exist there.
2. Using the matrix entry screen, you can modify the values of elements in the matrix. Assign new values wherever necessary and press [ENTER] after each one.
   - If you wish to modify the number of rows or columns, first press [ON/C] [MATH] [2]. You can then enter new values for the matrix dimensions.
3. When you have finished making changes, press [ON/C] to exit the matrix entry screen.
4. Press [MATH] [4] and select a memory (matA–matD) to store the newly-created matrix in.

Using Matrices in Calculations

Matrices stored in memories (matA–matD) can be used in arithmetic calculations (with the exception of division between matrices) and calculations that use x^3, x^2, and x^{-1}. You can also use the following matrix-specific functions that are available in the MATH menu.

dim (*matrix name, row, column*)	Returns a matrix with dimensions changed as specified.
fill (*value, row, column*)	Fills each element with a specified value.
cumul *matrix name*	Returns the cumulative matrix.
aug (*matrix name, matrix name*)	Appends the second matrix to the first matrix as new columns. The first and second matrices must have the same number of rows.
identity *value*	Returns the identity matrix with specified value of rows and columns.
rnd_mat (*row, column*)	Returns a random matrix with specified values of rows and columns.
det *matrix name*	Returns the determinant of a square matrix.
trans *matrix name*	Returns the matrix with the columns transposed to rows and the rows transposed to columns.
mat→list ([MATH] [7])	Creates lists with elements from the left column of each matrix (matA→L1, matB→L2, matC→L3, matD→L4) Mode changes from MATRIX mode to LIST mode.
matA→list ([MATH] [8])	Creates lists with elements from each column of the matrix. (matA→L1, L2, L3, L4) Mode changes from MATRIX mode to LIST mode.

Notes:

- When the matrix entry screen is displayed, you cannot perform matrix calculations because the MATH menu is not available.
- If the calculation result is a matrix, it will be displayed in the matrix entry screen (note that this replaces any existing data in the buffer). To store the calculation result, first press [ON/C] to exit the matrix entry screen. Press [MATH] [4] and select a memory (matA–matD) to store the newly-created matrix in.
- When the calculation results are in matrix form, pressing neither [◀] nor [▶] will bring you back to the original expression.

LIST CALCULATIONS

You can store and calculate up to four lists of up to sixteen elements each in LIST mode.

```
LIST MODE
```

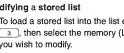
Press [MODE] [5] to enter LIST mode.

Note: You can use the MATH menu in LIST mode to edit, recall, and store lists, as well as to call list-specific functions.

Entering and Storing Lists

Before performing list calculations, a list must be created. Follow the steps below to enter and store lists.

1. Press [MODE] [5] to enter LIST mode.
2. Press [MATH] [2] to bring up the list entry screen.
   - Any list data remaining in the buffer, along with any previously entered, loaded, or calculated list data, will be displayed.
3. Define the list size (up to sixteen elements) by entering a value using the number keys and pressing [ENTER].



List entry screen (example)

4. Enter each element in the list by entering a value in the entry field and pressing [ENTER].
   - Each list element can display up to eight digits (the decimal point counts as one digit). If an element exceeds eight digits in length, it will be displayed in exponent notation within the list.
   - A maximum of six elements can be displayed at one time. Use [▲], [▼], [◀], and [▶] to move the cursor through the list.
5. When you have entered a value for each element, press [ON/C] to exit the list entry screen.
6. Press [MATH] [4] and select a memory (L1–L4) to store the newly-created list in.

Modifying a stored list

1. To load a stored list into the list entry screen, press [MATH] [3], then select the memory (L1–L4) that holds the list you wish to modify.
   - Loading new data into the screen will automatically replace any data that may already exist there.
2. Using the list entry screen, you can modify the values of elements in the list. Assign new values wherever necessary and press [ENTER] after each one.
   - If you wish to modify the size of a list, first press [ON/C] [MATH] [2]. You can then enter new values for the list size.
3. When you have finished making changes, press [ON/C] to exit the list entry screen.
4. Press [MATH] [4] and select a memory (L1–L4) to store the newly-created list in.

Using Lists in Calculations

Lists stored in memories (L1–L4) can be used in arithmetic calculations and calculations that use x^3, x^2, and x^{-1}. You can also use the following list-specific functions that are available in the MATH menu.

sortA *list name*	Sorts list in ascending order.
sortD *list name*	Sorts list in descending order.
dim (*list name, size*)	Returns a list with size changed as specified.
fill (*value, size*)	Enters the specified value for all items.
cumul *list name*	Sequentially cumulates each item in the list.
df_list *list name*	Returns a new list using the difference between adjacent items in the list.
aug (*list name, list name*)	Returns a list appending the specified lists.
min *list name*	Returns the minimum value in the list.
max *list name*	Returns the maximum value in the list.
mean *list name*	Returns the mean value of items in the list.
med *list name*	Returns the median value of items in the list.
sum *list name*	Returns the sum of items in the list.
prod *list name*	Returns the multiplication of items in the list.
stdDv *list name*	Returns the standard deviation of the list.
var *list name*	Returns the variance of the list.
o_prod (*list name, list name*)	Returns the outer product of 2 lists (vectors).
i_prod (*list name, list name*)	Returns the inner product of 2 lists (vectors).
abs_list *list name*	Returns the absolute value of the list (vector).
list→mat ([MATH] [7])	Creates matrices with left column data from each list. (L1→matA, L2→matB, L3→matC, L4→matD) Mode changes from LIST mode to MATRIX mode.
list→matA ([MATH] [8])	Creates a matrix with column data from each list. (L1, L2, L3, L4→matA) Mode changes from LIST mode to MATRIX mode.

Notes:

- When the list entry screen is displayed, you cannot perform list calculations because the MATH menu is not available.
- If the calculation result is a list, it will be displayed in the list entry screen (note that this replaces any existing data in the buffer). To store the calculation result, first press [ON/C] to exit the list entry screen. Press [MATH] [4] and select a memory (L1–L4) to store the newly-created list in.
- When the calculation results are in list form, pressing neither [◀] nor [▶] will bring you back to the original expression.

EQUATION SOLVERS

The results obtained by these functions may include a margin of error.

Simultaneous Linear Equations

Simultaneous linear equations with two unknowns (2-VLE) or with three unknowns (3-VLE) may be solved using the following functions.

① 2-VLE: [MODE] [6] [0]

$$\begin{bmatrix} a_1x + b_1y = c_1 \\ a_2x + b_2y = c_2 \end{bmatrix} \quad |D| = \begin{vmatrix} a_1 & b_1 \\ a_2 & b_2 \end{vmatrix}$$

② 3-VLE: [MODE] [6] [1]

$$\begin{bmatrix} a_1x + b_1y + c_1z = d_1 \\ a_2x + b_2y + c_2z = d_2 \\ a_3x + b_3y + c_3z = d_3 \end{bmatrix} \quad |D| = \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}$$

- If the determinant D = 0, an error occurs.
- If the absolute value of an intermediate result or calculation result is 1×10^{100} or more, an error occurs.

Solving simultaneous linear equations

1. Press [MODE] [6] [0] or [MODE] [6] [1].
2. Enter the value for each coefficient (a_n, etc.).
   - Coefficients can be entered using ordinary arithmetic operations.
   - To clear the entered coefficient, press [ON/C].
   - Press [▲] or [▼] to move the cursor up or down through the coefficients. Press [2nd F] [▲] or [2nd F] [▼] to jump to the first or last coefficient.
3. When all coefficients have been entered, press [ENTER] to solve the equation.
   - While the solution is displayed, press [ENTER] or [ON/C] to return to the coefficient entry display. To clear all the coefficients, press [2nd F] [CA].

Quadratic and Cubic Equations

Quadratic ($ax^2 + bx + c = 0$) or cubic ($ax^3 + bx^2 + cx + d = 0$) equations may be solved using the following functions.

① Quadratic equation solver: [MODE] [6] [2]
② Cubic equation solver: [MODE] [6] [3]

Solving quadratic and cubic equations

- Press [MODE] [6] [2] or [MODE] [6] [3].
- Coefficients for these equations can be entered in the same manner as those for simultaneous linear equations.

ERRORS AND CALCULATION RANGES

Errors

An error will occur if an operation exceeds the calculation ranges, or if a mathematically illegal operation is attempted. When an error occurs, pressing [◀] or [▶] automatically moves the cursor back to the place in the equation where the error occurred. Edit the equation or press [ON/C] or [2nd F] [CA] to clear the equation.

Error codes and error types

ERROR 01: Syntax error
- An attempt was made to perform an invalid operation.
  Ex. 2 [×] [−] 5 [−]

ERROR 02: Calculation error
- The absolute value of an intermediate or final calculation result equals or exceeds 10^{100}.
- An attempt was made to divide by zero (or an intermediate calculation resulted in zero).
- The calculation ranges were exceeded while performing calculations.

ERROR 03: Nesting error
- The available number of buffers was exceeded. (There are 10 buffers* for numeric values and 64 buffers for calculation instructions).
- 5 buffers in CPLX mode, and 1 buffer for matrix/list data.

ERROR 04: Data over error
- Data items exceeded 100 in STAT mode.

ERROR 07: Definition error
- Matrix/List definition error or the attempted entering of an invalid value.

ERROR 08: DIM unmatched error
- Matrix/List dimensions inconsistent while calculating.

ERROR 09: Invalid DIM error
- Size of matrix/list exceeds calculation range.

ERROR 10: Undefined error
- Undefined matrix/list used in calculation.

Alert Messages

Cannot delete!
- The selected item cannot be deleted by pressing [BS] or [2nd F] [DEL] in the WriteView editor.
  Ex. [2nd F] [.'] 5 [▶] [X] [◀] [BS]
  In this example, delete the exponent before attempting to delete the parentheses.

Cannot call!
- The function or operation stored in definable memory (D1 to D4) cannot be called.
  Ex. An attempt was made to recall a statistical variable from within NORMAL mode.
- Expressions stored in formula memories (F1 to F4) cannot be called.

Buffer full!
- The equation (including any calculation ending instructions) exceeded its maximum input buffer (159 characters in the WriteView editor or 161 characters in the Line editor). An equation may not exceed its maximum input buffer.

Calculation Ranges

- **Within the ranges specified, this calculator is accurate to ±1 of the 10th digit of the mantissa. However, a calculation error increases in continuous calculations due to accumulation of each calculation error. (This is the same for y^x, $\sqrt[x]{\ }$, ln, e^x, ln, Matrix/List calculations, etc., where continuous calculations are performed internally.) Additionally, a calculation error will accumulate and become larger in the vicinity of inflection points and singular points of functions.**
- Calculation ranges
  $\pm 10^{-99}$ to $\pm 9.999999999 \times 10^{99}$ and 0.
  If the absolute value of an entry or a final or intermediate result of a calculation is less than 10^{-99}, the value is considered to be 0 in calculations and in the display.

Display of results using √

Calculation results may be displayed using √ when all of the following conditions are met:

- When intermediate and final calculation results are displayed in the following form:
  $\pm\frac{a\sqrt{b}}{e} \pm \frac{c\sqrt{d}}{f}$
- When each coefficient falls into the following ranges:
  $1 \le a < 100$; $1 < b < 1{,}000$; $0 \le c < 100$;
  $1 \le d < 1{,}000$; $1 \le e < 100$; $1 \le f < 100$
- When the number of terms in the intermediate and final calculation results is one or two.

Note: The result of two fractional terms that include √ will be reduced to a common denominator.

BATTERY REPLACEMENT

Notes on Battery Replacement

Improper handling of batteries can cause electrolyte leakage or explosion. Be sure to observe the following handling rules:

- Make sure the new battery is the correct type.
- When installing, orient the battery properly as indicated in the calculator.
- The battery is factory-installed before shipment, and may be exhausted before it reaches the service life stated in the specifications.

Notes on erasure of memory contents

When the battery is replaced, the memory contents are erased. Erasure can also occur if the calculator is defective or when it is repaired. Make a note of all important memory contents in case accidental erasure occurs.

When to Replace the Battery

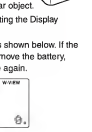
If the display has poor contrast or nothing appears on the display when [ON/C] is pressed in dim lighting, even after adjusting the display contrast, it is time to replace the battery.

Cautions

- An exhausted battery left in the calculator may leak and damage the calculator.
- Fluid from a leaking battery accidentally entering an eye could result in serious injury. Should this occur, wash with clean water and immediately consult a doctor.
- Should fluid from a leaking battery come in contact with your skin or clothes, immediately wash with clean water.
- If the product is not to be used for some time, to avoid damage to the unit from a leaking battery, remove it and store in a safe place.
- Do not leave an exhausted battery inside the product.
- Keep batteries out of the reach of children.
- Explosion risk may be caused by incorrect handling.
- Do not throw batteries into a fire as they may explode.

Replacement Procedure

1. Turn the power off by pressing [2nd F] [OFF].
2. Remove one screw. (Fig. 1)
3. Lift the battery cover to remove.
4. Remove the used battery by prying it out with a ball-point pen or other similar pointed device. (Fig. 2)
5. Install one new battery. Make sure the "+" side is facing up.
6. Replace the cover and screw.
7. Press the RESET switch (on the back) with the tip of a ball-point pen or similar object.
8. Adjust the display contrast. See "Adjusting the Display Contrast".
   - Make sure that the display appears as shown below. If the display does not appear as shown, remove the battery, reinstall it, and check the display once again.




```
DEG                    W-VIEW
        NORMAL MODE
M1                        0.
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Automatic Power Off Function

This calculator will turn itself off to save battery power if no key is pressed for approximately 10 minutes.

SPECIFICATIONS

Calculation features:	Scientific calculations, complex number calculations, equation solvers, statistical calculations, etc.
Drill features:	Math Drill and Multiplication Table
Display:	96 × 32 dot matrix liquid crystal display
Display of calculation results:	Mantissa: 10 digits Exponent: 2 digits
Internal calculations:	Mantissas of up to 14 digits
Pending operations:	64 calculations 10 numeric values (5 numeric values in CPLX mode, and 1 numeric value for Matrix/List data.)
Power source:	Built-in solar cells 1.5 V ⎓ (DC): Backup battery (Alkaline battery (LR44 or equivalent) × 1)
Operating time: (varies according to use and other factors)	Approx. 3,000 hours when continuously displaying 55555. at 25°C (77°F), using the alkaline battery only
Operating temperature:	0°C–40°C (32°F–104°F)
External dimensions:	80 mm (W) × 168 mm (D) × 14 mm (H) 3-5/32" (W) × 6-5/8" (D) × 9/16" (H)
Weight:	Approx. 98.5 g (0.22 lb) (including battery)
Accessories:	Battery × 1 (installed), operation manual, calculation examples, and hard case

FOR MORE INFORMATION ABOUT SCIENTIFIC CALCULATORS

Visit our Web site.
http://sharp-world.com/calculator/

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